



# WANTED: New Technologies for NASA's Journey to Mars

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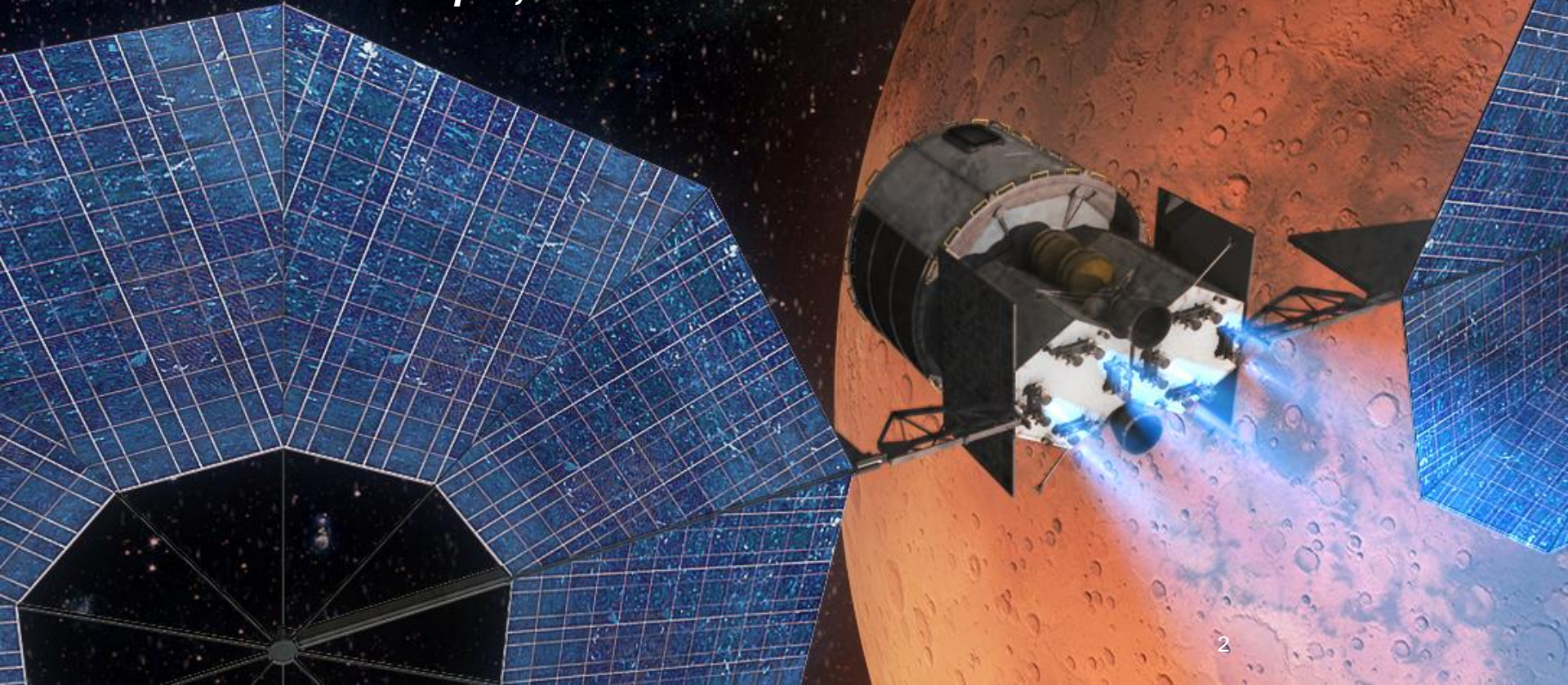


# Pioneering Space - Goals



***“Fifty years after the creation of NASA, our goal is no longer just a destination to reach. Our goal is the capacity for people to work and learn and operate and live safely beyond the Earth for extended periods of time, ultimately in ways that are more sustainable and even indefinite. And in fulfilling this task, we will not only extend humanity’s reach in space -- we will strengthen America’s leadership here on Earth.”***

***- President Obama - April, 2010***

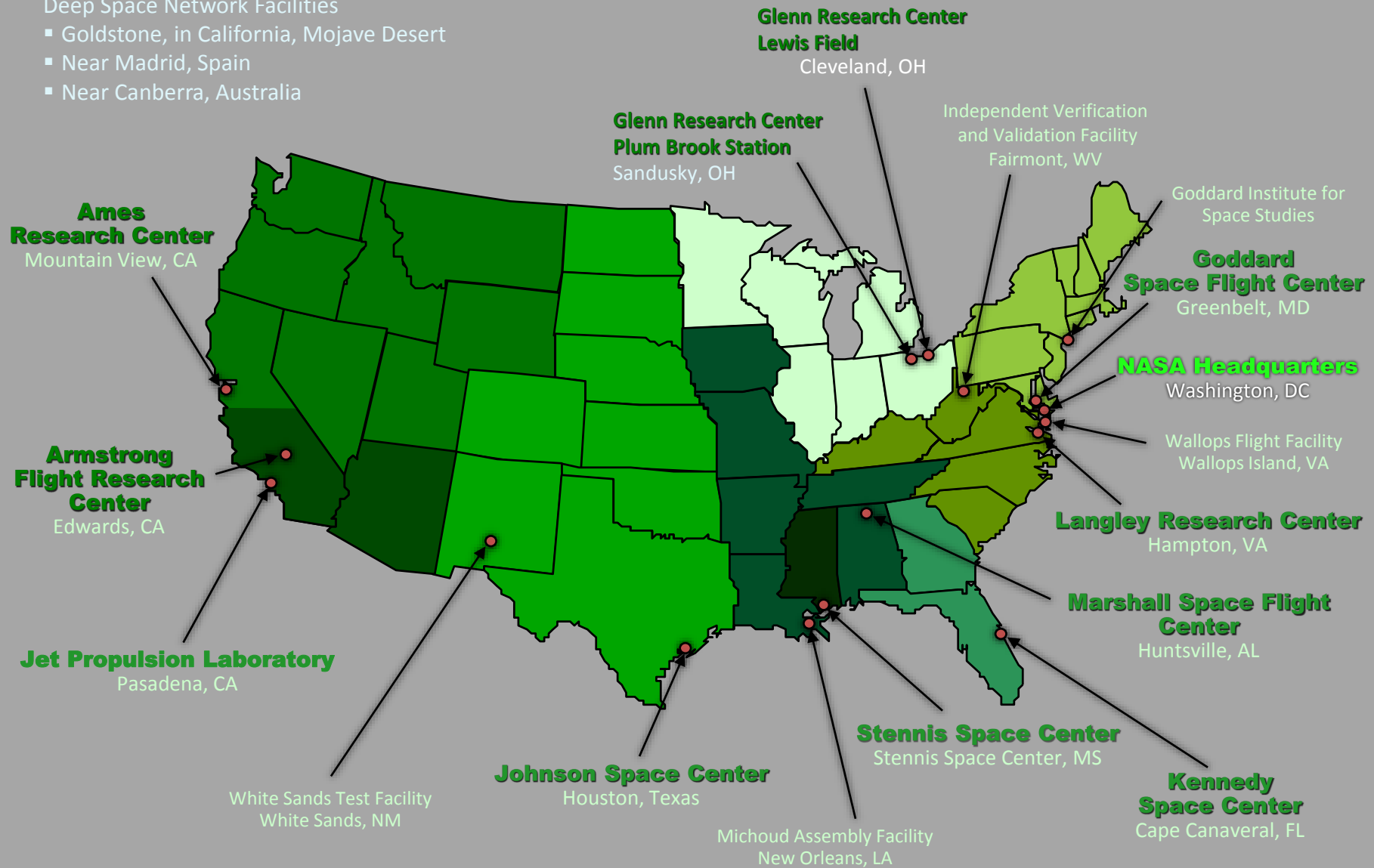


# NASA Centers and Installations



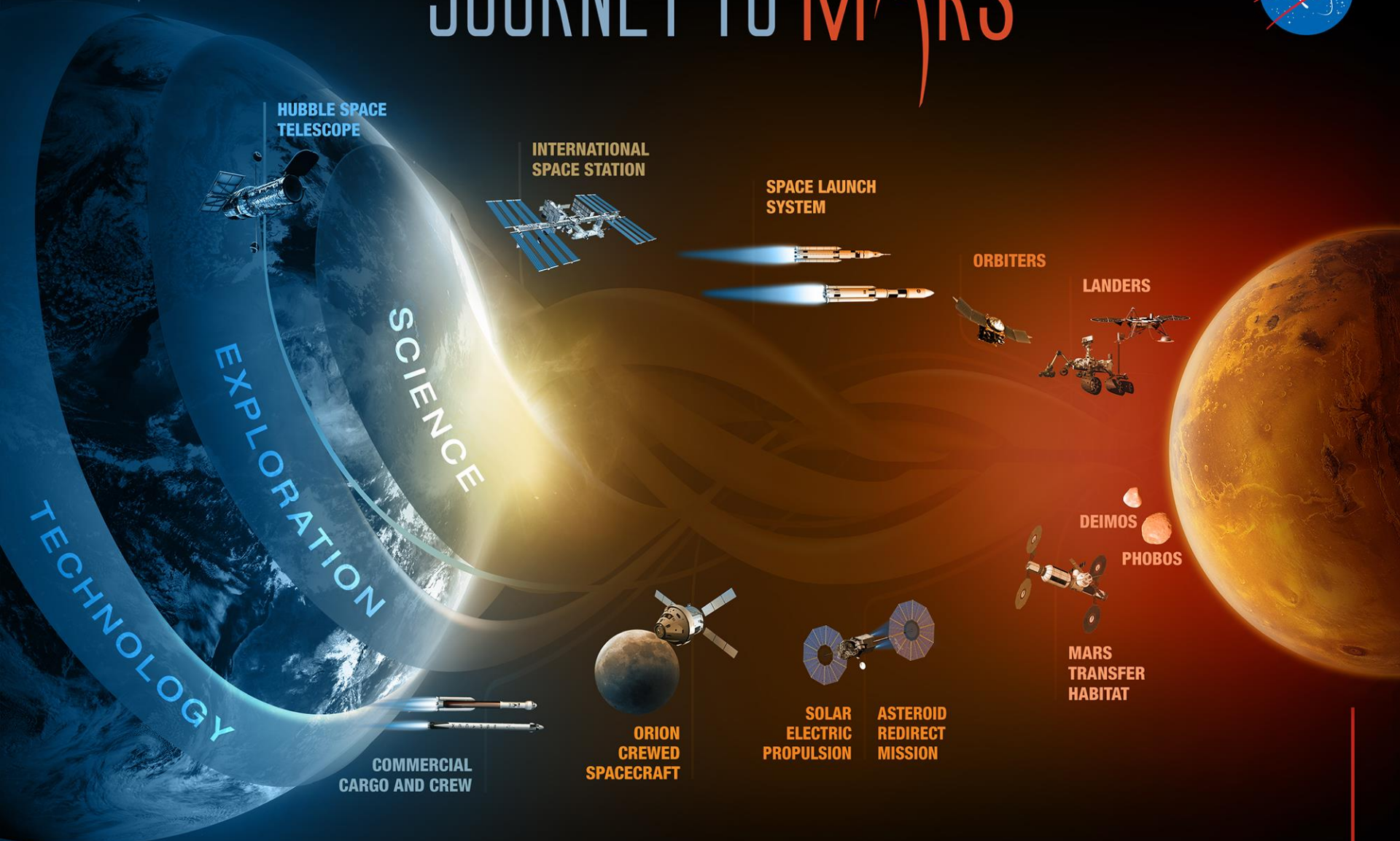
## Deep Space Network Facilities

- Goldstone, in California, Mojave Desert
- Near Madrid, Spain
- Near Canberra, Australia





# JOURNEY TO MARS



MISSIONS: 6-12 MONTHS  
RETURN: HOURS

EARTH RELIANT

MISSIONS: 1-12 MONTHS  
RETURN: DAYS

PROVING GROUND

MISSIONS: 2-3 YEARS  
RETURN: MONTHS

EARTH INDEPENDENT



# Evolvable Mars Campaign – Capability & Mission Extensibility



EARTH RELIANT

PROVING GROUND

EARTH INDEPENDENT

## Capabilities

International Space Station



70+ MT SLS



Asteroid Redirect Vehicle

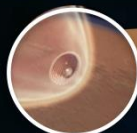
105+ MT SLS



Advanced Propulsion



EDL Pathfinder



Mars Surface

EDL/Lander



130+ MT SLS



Long Duration Habitat

Long Duration Surface Systems



Staying Healthy



Exploration Augmentation Module

Transportation

Working In Space

ISRU



EM-X Crewed Missions in Cis-lunar space



Mars 2020



Asteroid Redirect Robotic Mission



Proving Ground Missions to Returned Asteroid & EAM for Mars risk reduction

All Paths Through Mars Orbit

ISS Deep Space & Mars Risk Reduction

Deep Space Mars Preparation



Mars Moon Missions



First Human Mission to Mars Surface

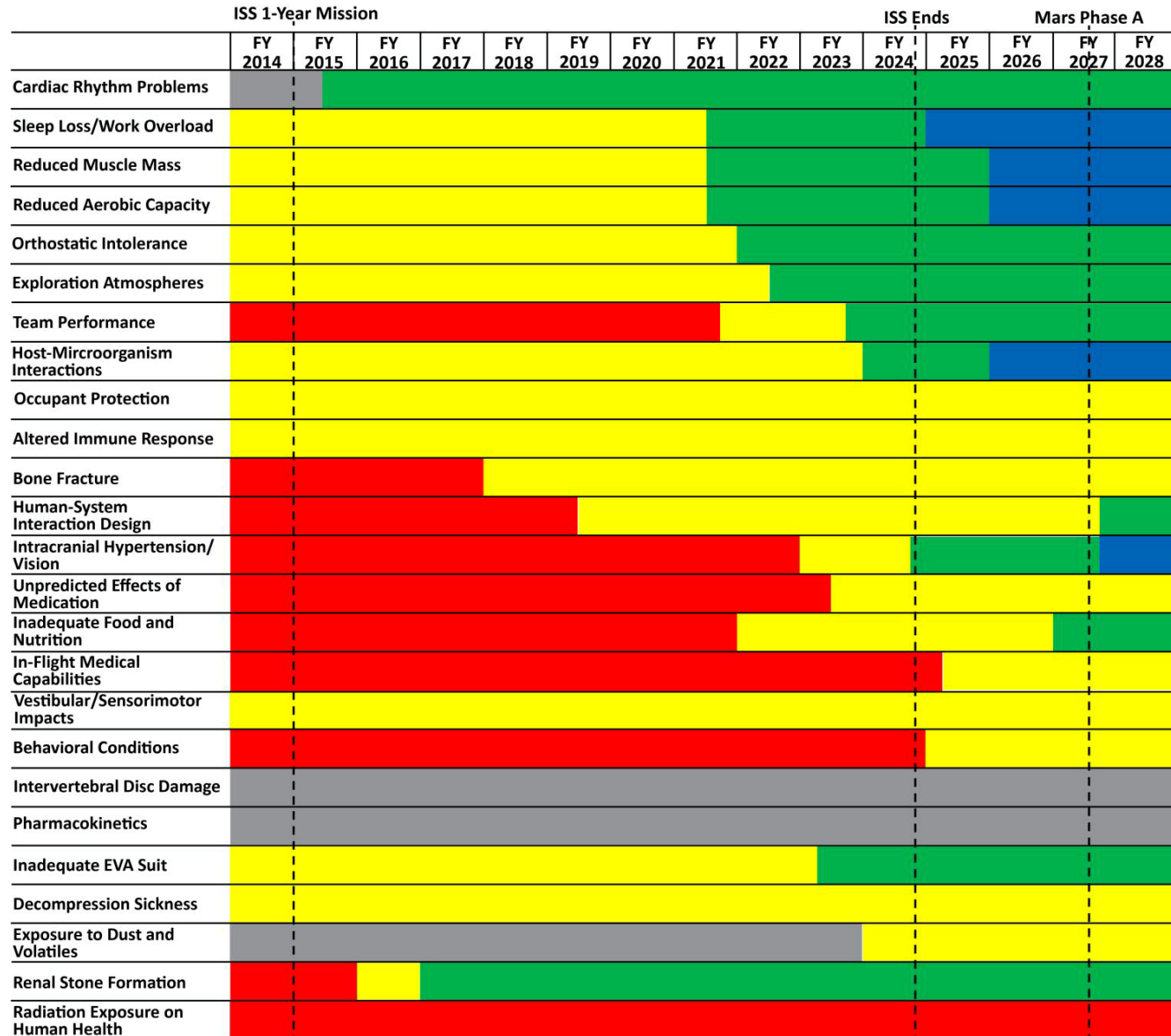


Long Duration Human Missions

## Missions



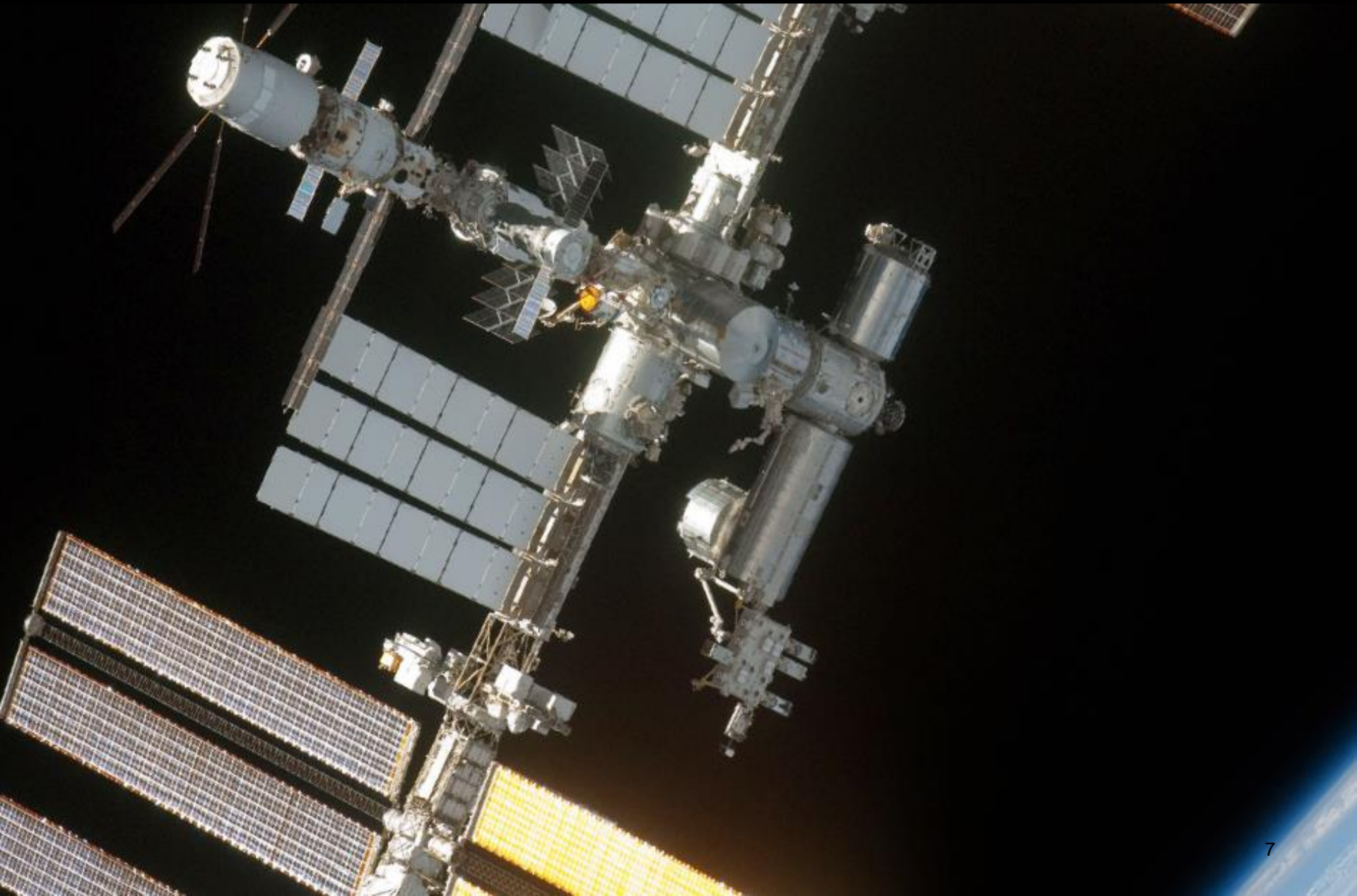
# Solving Risks with Technology Development



Research Rating: ■ Uncontrolled ■ Partially Controlled ■ Controlled ■ Optimized ■ Insufficient Data

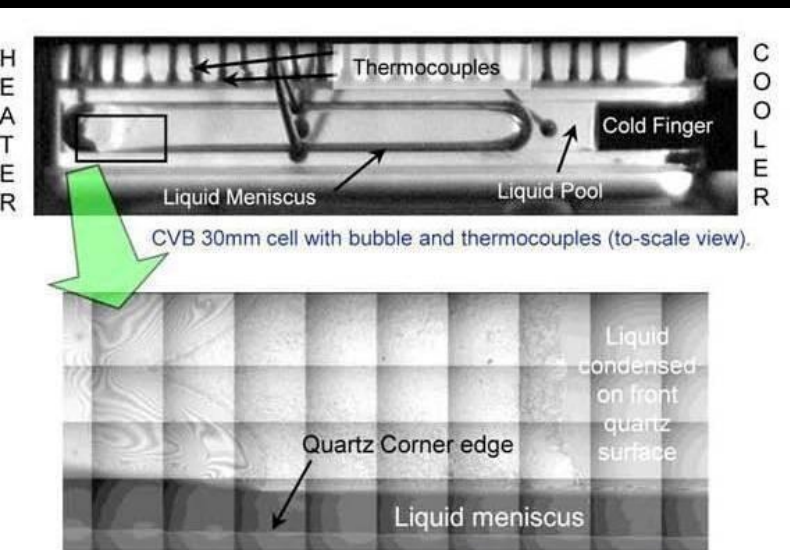
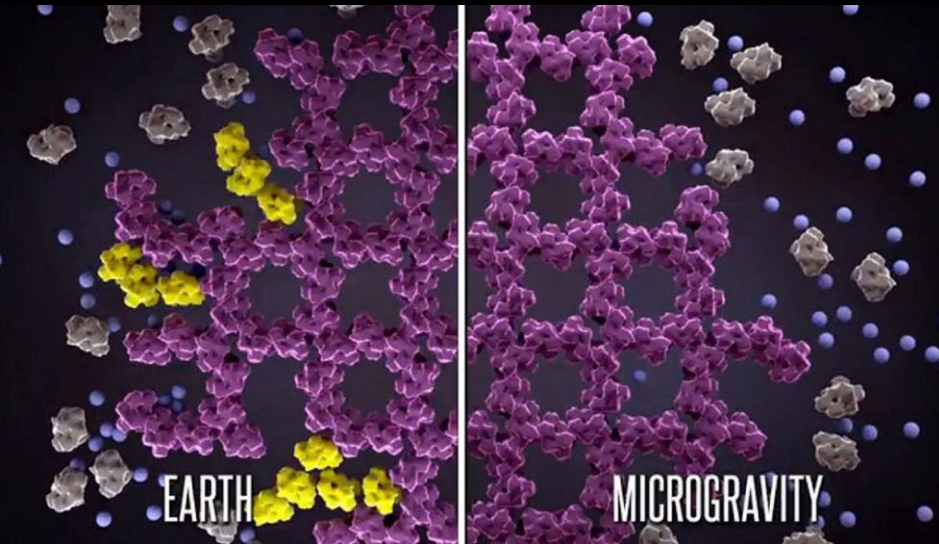


# Earth Reliant Phase – Working on ISS



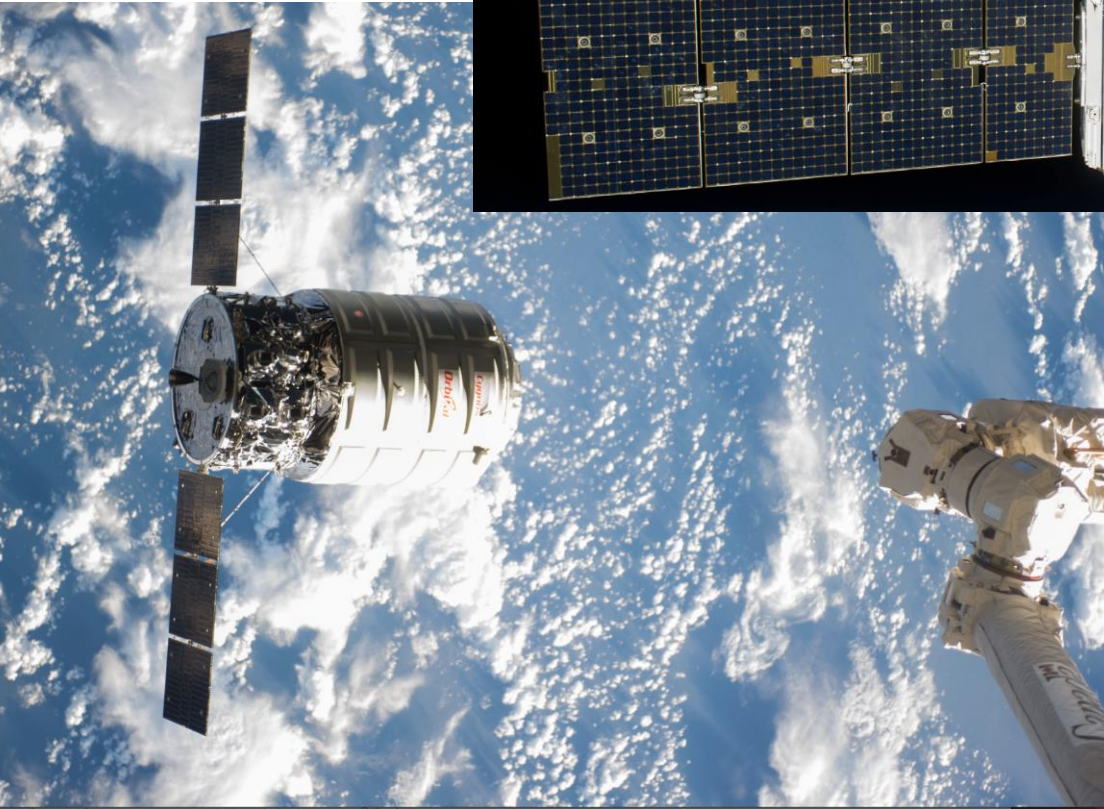
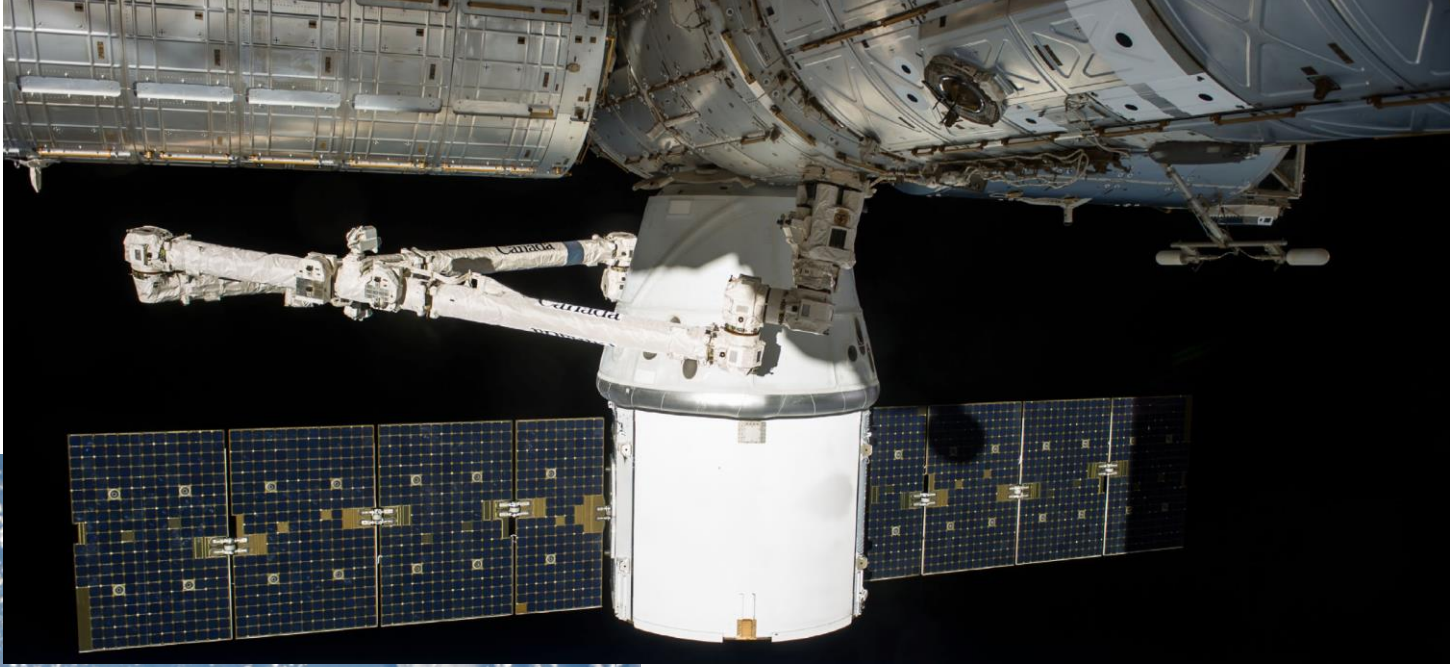


# ISS Research

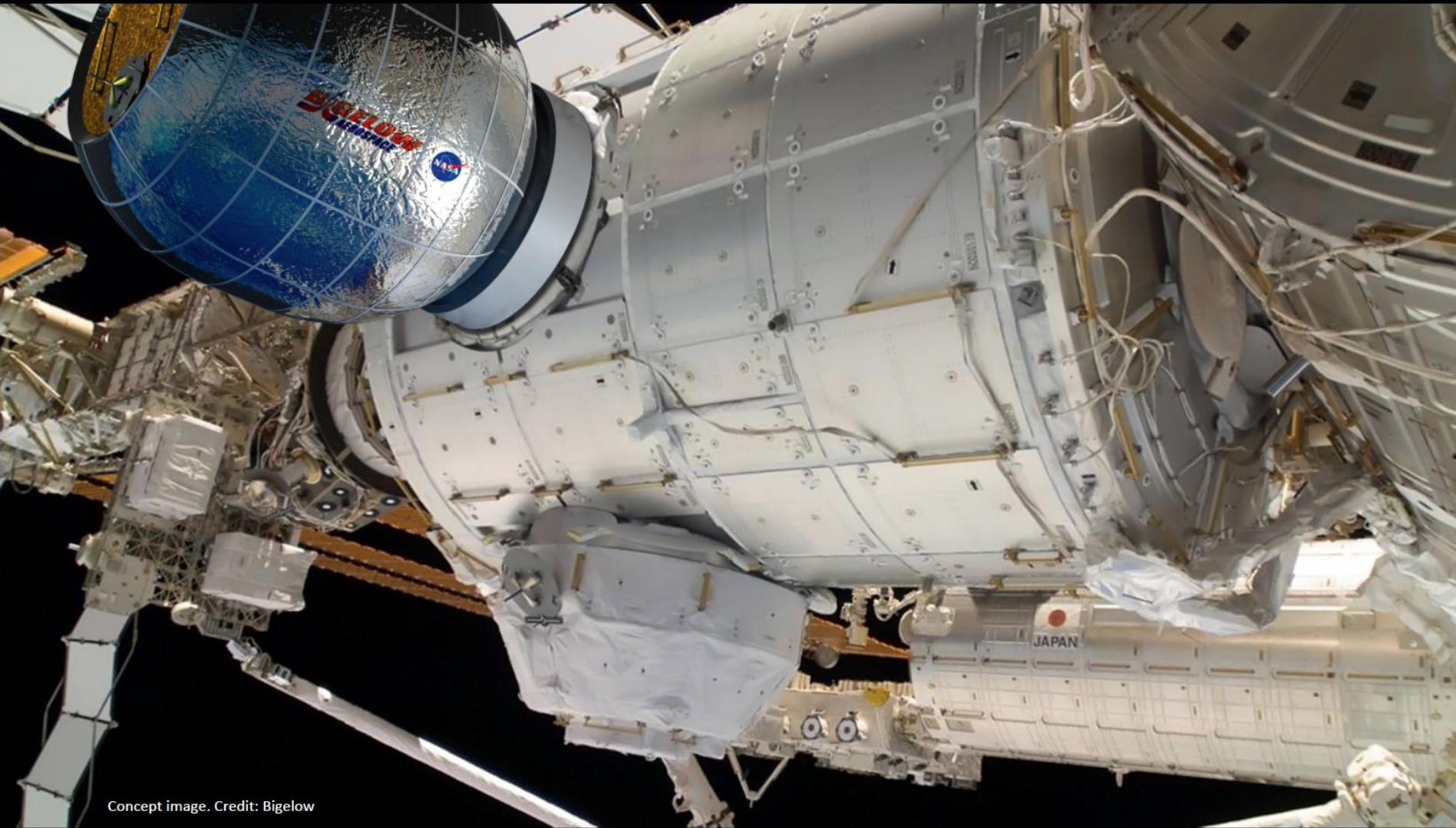




# Commercial Cargo



# Commercial Partnerships



Concept image. Credit: Bigelow



# THE WORLD'S MOST POWERFUL ROCKET

## Interim Cryogenic Propulsion Stage:

The upper stage for the first SLS launch will push Orion beyond the moon.

## Orion:

Carries explorers safely into space & back.

## Stage Adapter:

Provides space for sending several small spacecraft to the moon and beyond.

## Core Stage:

Larger than any other rocket stage, the SLS core stage holds fuel for launch.

## Solid Rocket Boosters:

The largest boosters to ever fly will provide most of the power for the first two minutes of flight.

## RS-25 Engines:

The most reliable engines of their kind; upgraded with new technology.

# LAUNCHING THE JOURNEY



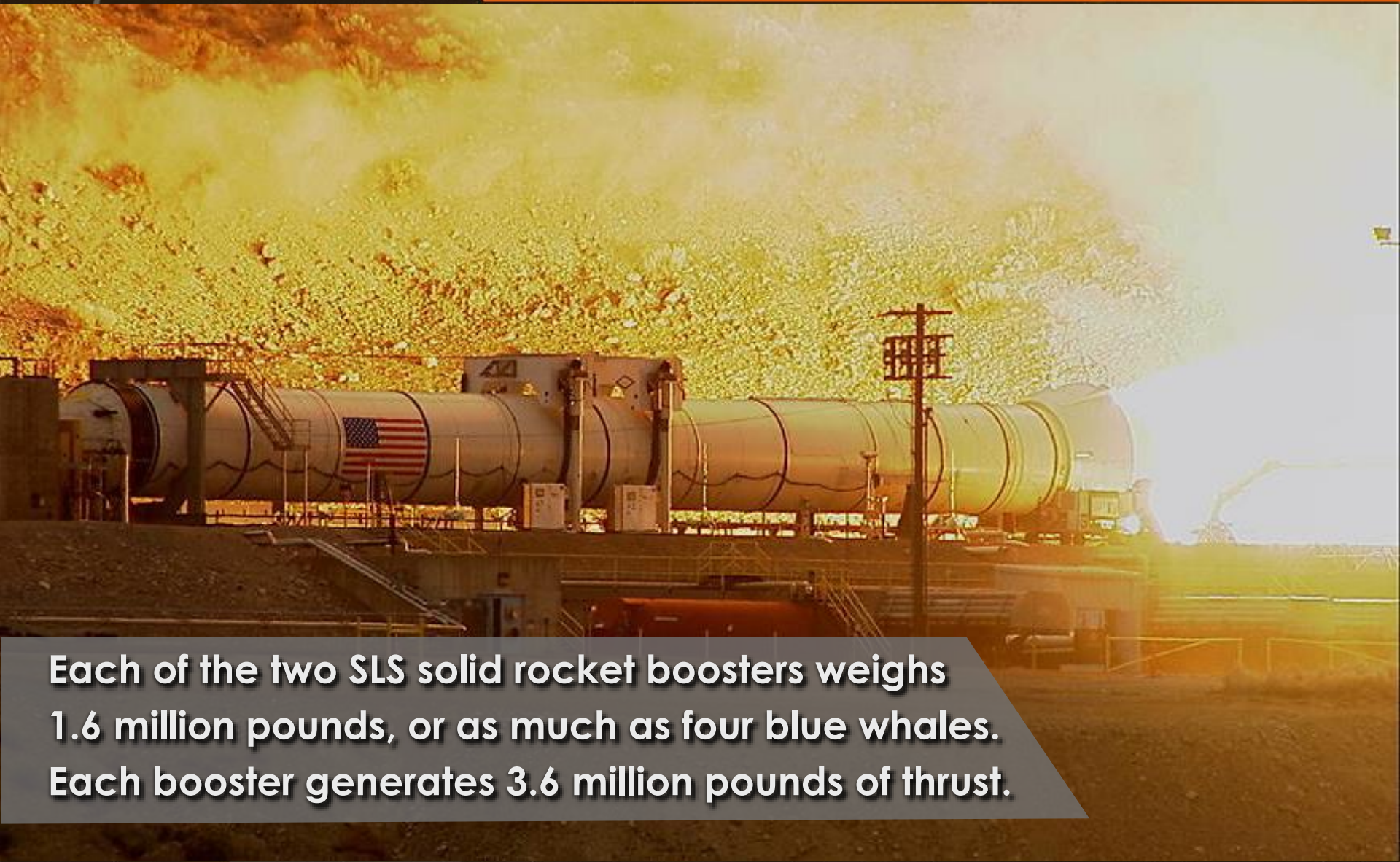
In December 2014, the Journey to Mars took a huge leap forward with Orion's first flight, Exploration Flight Test-1.







# BUILDING A BETTER BOOSTER




Each of the two SLS solid rocket boosters weighs 1.6 million pounds, or as much as four blue whales. Each booster generates 3.6 million pounds of thrust.







# DESIGNED FOR PERFORMANCE

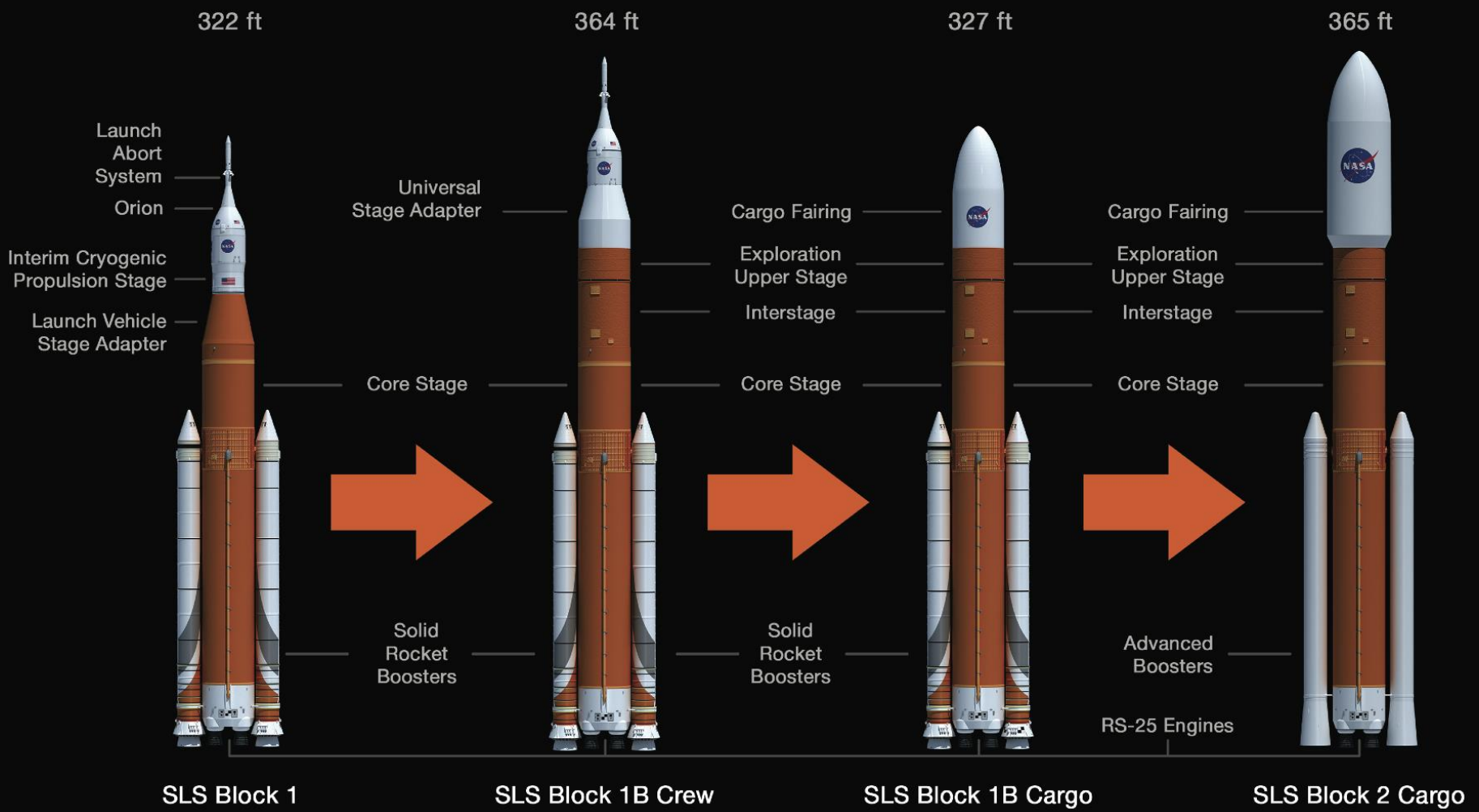


The four RS-25 engines in the Core Stage will generate as much power as 16 Hoover Dams.



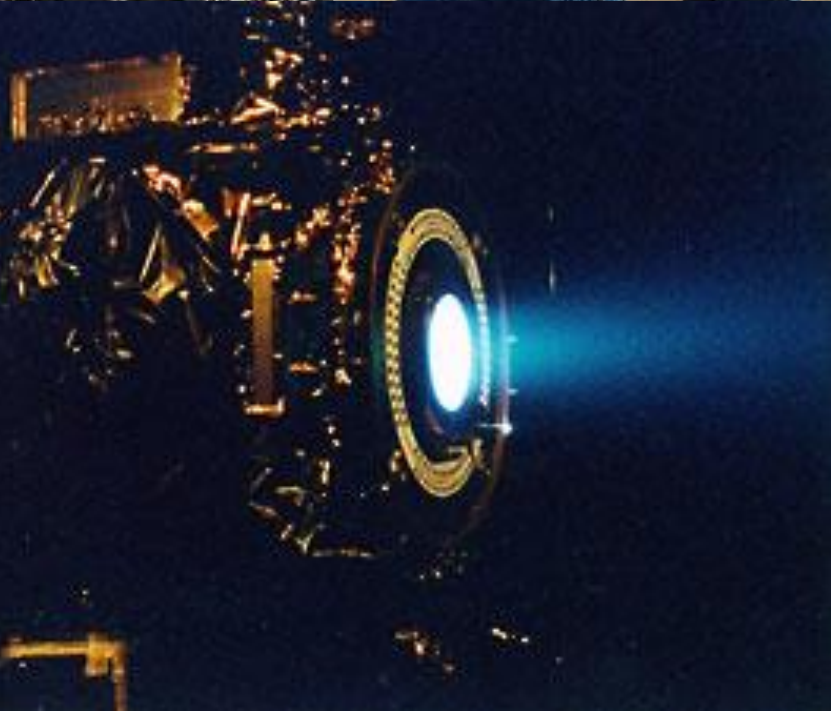


# Future Evolution Plans for Space Launch System (SLS)



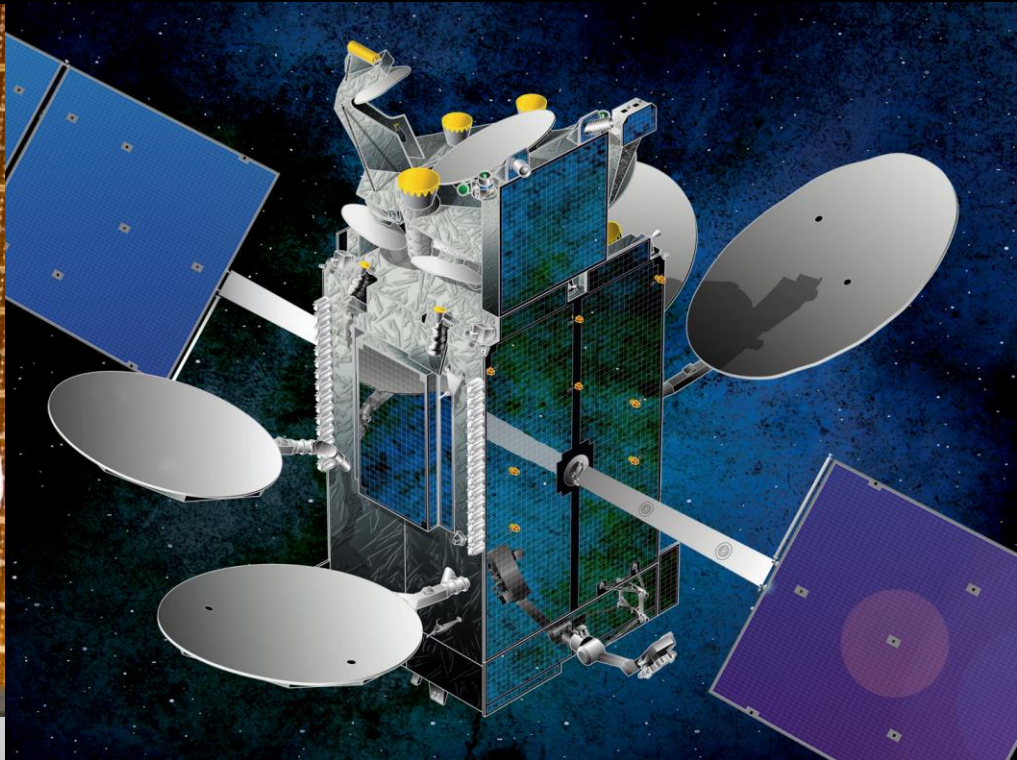
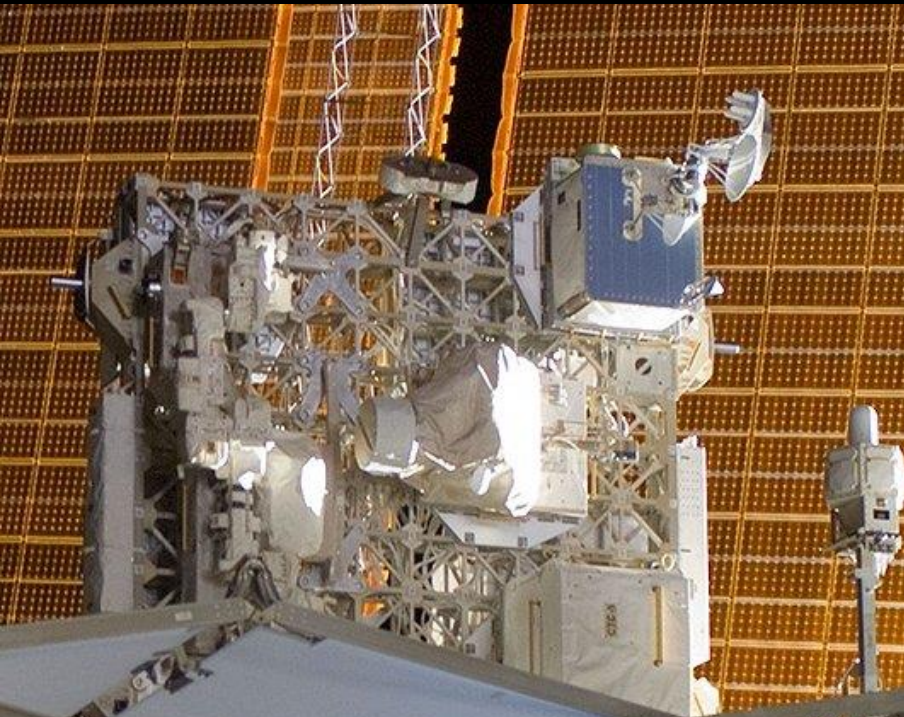


# Propulsion Research





# Communications





# Next Generation Space Suits



# Growing Plants in space





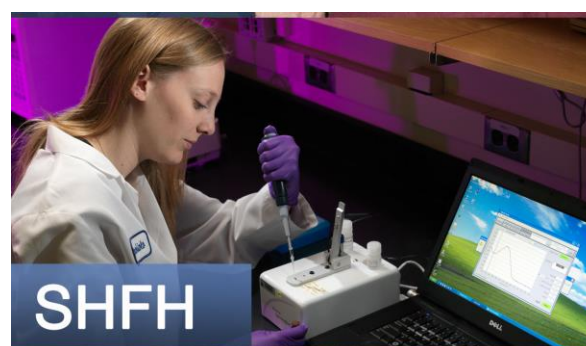
# Staying Healthy – Human Research Program (HRP)



ISS Medical Project

Human Health and  
Countermeasures

Exploration Medical Capabilities



Behavioral Health  
And Performance

Space Human Factors  
And Habitability

Science Management

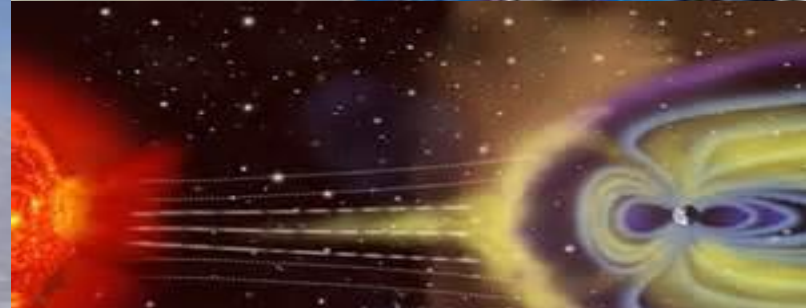


# Habitat studies

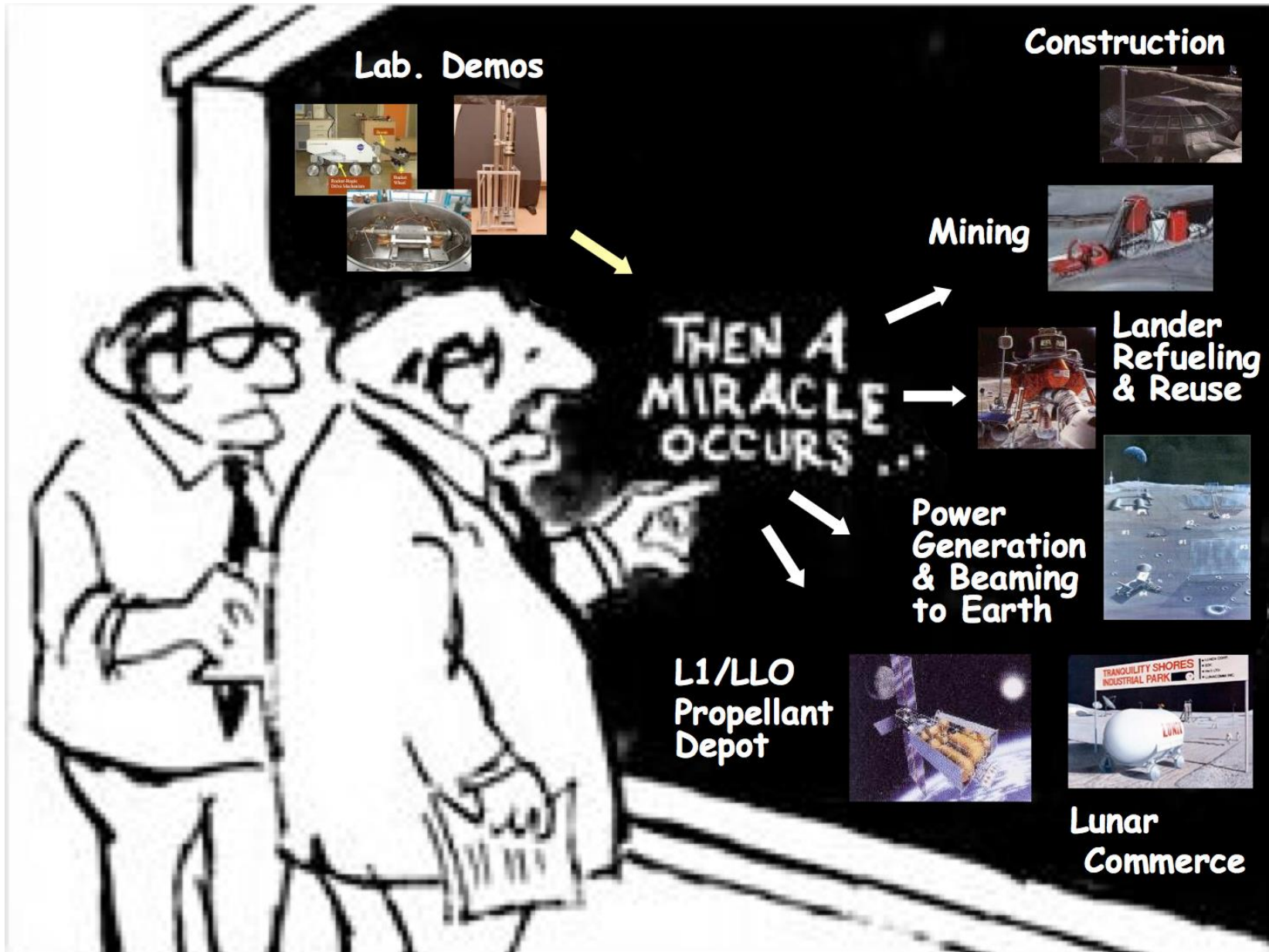




# Radiation studies

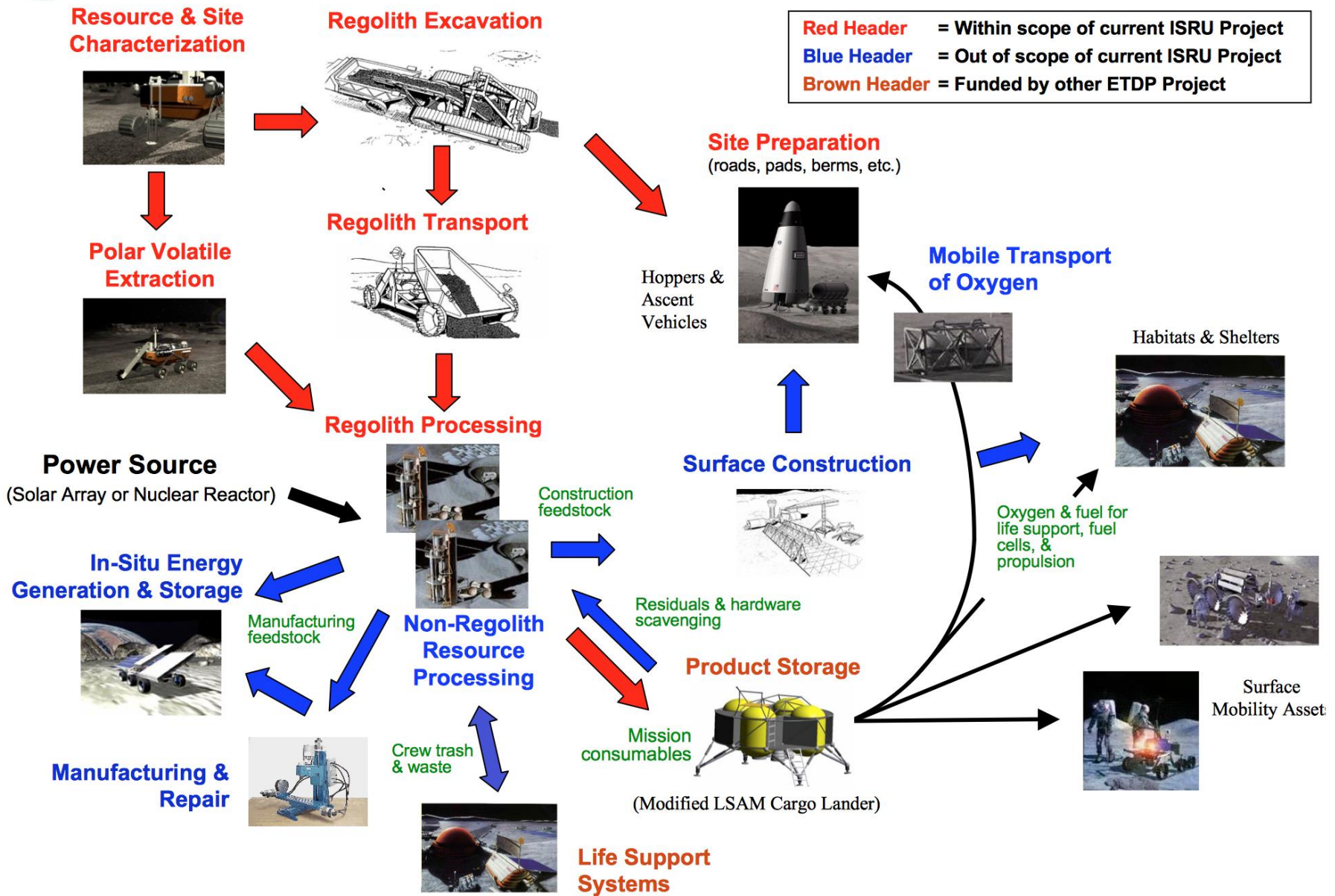


# In Space Resource Utilization



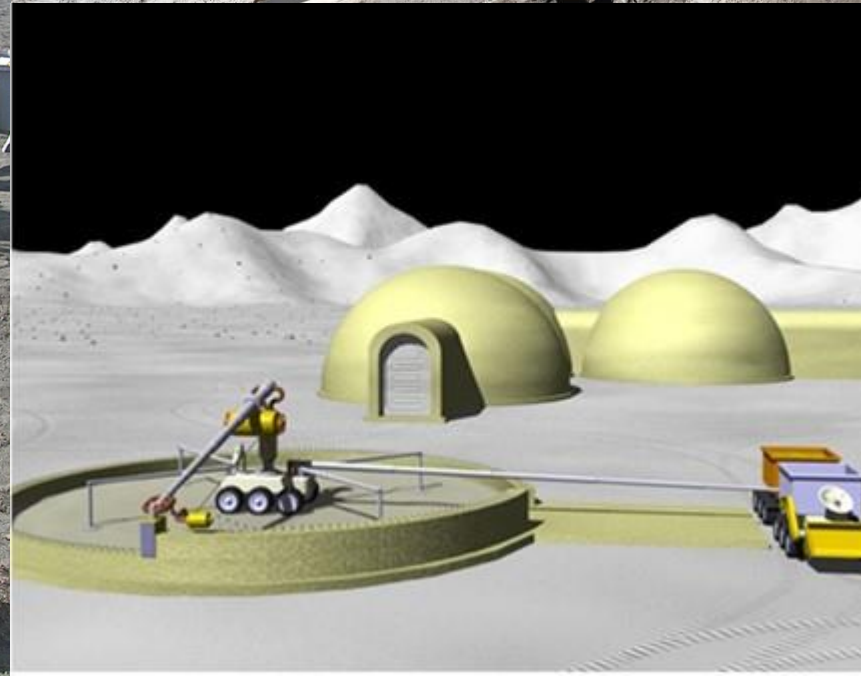
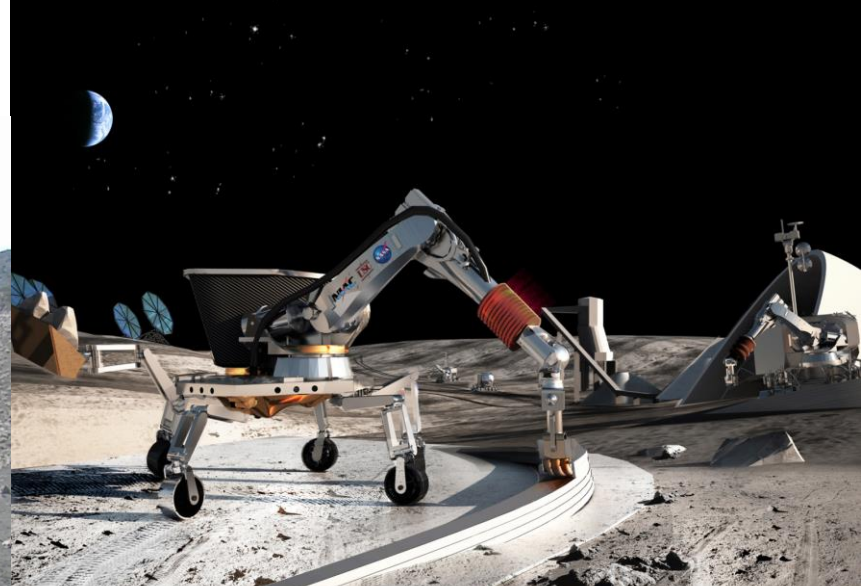


# In Space Resource Utilization





# In Space Resource Utilization



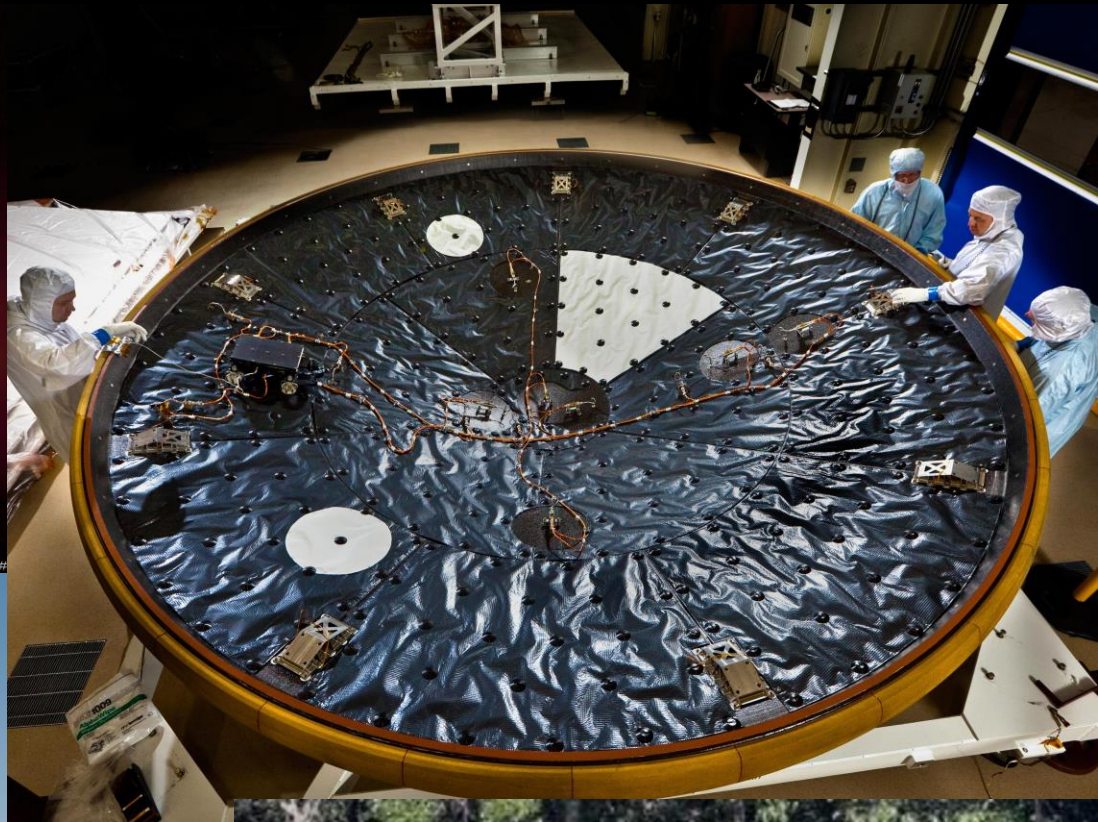


# Surface Power and Mobility





# Ascent and Descent





# How to get involved?



Check for NASA solicitations: <https://nspires.nasaprs.com>



## NASA Research

### Solicitations

## View Solicitations

### Future

### Open

### Closed/Past Selected

## Solicitations

### Open Solicitations

**NOTE:** Click on the Solicitation # link for information on a specific solicitation. You may refine this list or change its scope by entering keywords corresponding to the listed columns.

Keywords:  Display  records per page

Showing 1 to 25 of 72 records

First Previous **1** 2 3 Next Last

Solicitation Title	Solicitation #	Released	NOI Due	Proposal Due
2016 Dual Use Technology Development Cooperative Agreement Notice (CAN) at NASA George C. Marshall Space Flight Center	<a href="#">NNM16567212C</a>	10/09/2015	--	--
2016 Experimental Program to Stimulate Competitive Research (EPSCoR)	<a href="#">NNH16ZHA001C</a>	12/11/2015	01/25/2016	03/21/2016
Advanced Component Technology	<a href="#">NNH15ZDA001N-ACT</a>	02/13/2015	--	--
Advanced Information Systems Technology	<a href="#">NNH15ZDA001N-AIST</a>	02/13/2015	--	--
Airborne Instrument Technology Transition	<a href="#">NNH15ZDA001N-AITT</a>	02/13/2015	--	--
Announcement of Opportunity soliciting for proposals using the Human Spaceflight Analogue "Bedrest" non-US proposers only)	<a href="#">ESA_AO_16_BR</a>	02/01/2016	--	03/15/2016
Appendix G: Physiological and Behavioral Responses in Humans to Intermittent Artificial Gravity during Bed Rest	<a href="#">NNJ15ZSA001N-ACBR</a>	12/01/2015	--	(See Announcement)
Astrophysics Research and Analysis	<a href="#">NNH15ZDA001N-APRA</a>	02/13/2015	01/22/2016	03/18/2016
Astrophysics Theory	<a href="#">NNH15ZDA001N-ATP</a>	02/13/2015	--	--
Atmospheric Composition: Modeling and Analysis	<a href="#">NNH15ZDA001N-ACMAP</a>	02/13/2015	--	--
Biodiversity	<a href="#">NNH15ZDA001N-BIO</a>	02/14/2015	01/15/2016	03/18/2016
Carbon Cycle Science	<a href="#">NNH15ZDA001N-CARBON</a>	02/13/2015	--	--
Carbon Monitoring System	<a href="#">NNH15ZDA001N-CMS</a>	02/14/2015	01/29/2016	03/29/2016
Computational Modeling Algorithms and Cyberinfrastructure	<a href="#">NNH15ZDA001N-CMAC</a>	02/13/2015	--	--
Cooperative Agreement Notice (CAN) 2016 at NASA John C. Stennis Space Center	<a href="#">NNS16ZDA002C</a>	01/27/2016	--	--
D.2 Leading Edge Aeronautics Research for NASA Project (LEARN3)	<a href="#">NNH15ZEA001N-LEARN3</a>	10/20/2015	--	(See Announcement)
DRAFT Heliophysics Guest Investigator ROSES 2016	<a href="#">NNH16ZDAHGDRAFT</a>	01/15/2016	--	--
DRAFT Solar System Exploration Research Virtual Institute (SSERVI) Cooperative Agreement Notice	<a href="#">NNH16ZDA002J</a>	01/15/2016	--	--
Earth Science Applications: Socioeconomic Benefits	<a href="#">NNH15ZDA001N-SEB</a>	02/14/2015	01/22/2016	03/24/2016
Earth Science U.S. Participating Investigator	<a href="#">NNH15ZDA001N-ESUSPI</a>	02/13/2015	--	--

# How to get involved?



Search one of NASA's Technology Roadmaps:

<http://www.nasa.gov/offices/oct/home/roadmaps/index.html>

TA 1		LAUNCH PROPULSION SYSTEMS	TA 9		ENTRY, DESCENT, AND LANDING SYSTEMS
TA 2		IN-SPACE PROPULSION TECHNOLOGIES	TA 10		NANOTECHNOLOGY
TA 3		SPACE POWER AND ENERGY STORAGE	TA 11		MODELING, SIMULATION, INFORMATION TECHNOLOGY, AND PROCESSING
TA 4		ROBOTICS AND AUTONOMOUS SYSTEMS	TA 12		MATERIALS, STRUCTURES, MECHANICAL SYSTEMS, AND MANUFACTURING
TA 5		COMMUNICATIONS, NAVIGATION, AND ORBITAL DEBRIS TRACKING AND CHARACTERIZATION SYSTEMS	TA 13		GROUND AND LAUNCH SYSTEMS
TA 6		HUMAN HEALTH, LIFE SUPPORT, AND HABITATION SYSTEMS	TA 14		THERMAL MANAGEMENT SYSTEMS
TA 7		HUMAN EXPLORATION DESTINATION SYSTEMS	TA 15		AERONAUTICS
TA 8		SCIENCE INSTRUMENTS, OBSERVATORIES, AND SENSOR SYSTEMS			



# Technology Road Maps



National Aeronautics and  
Space Administration



## Technology Area 12 Materials, Structures, Mechanical Systems, and Manufacturing 1 of 7

## Enabling Technology Candidates Mapped to the Technology Need Date

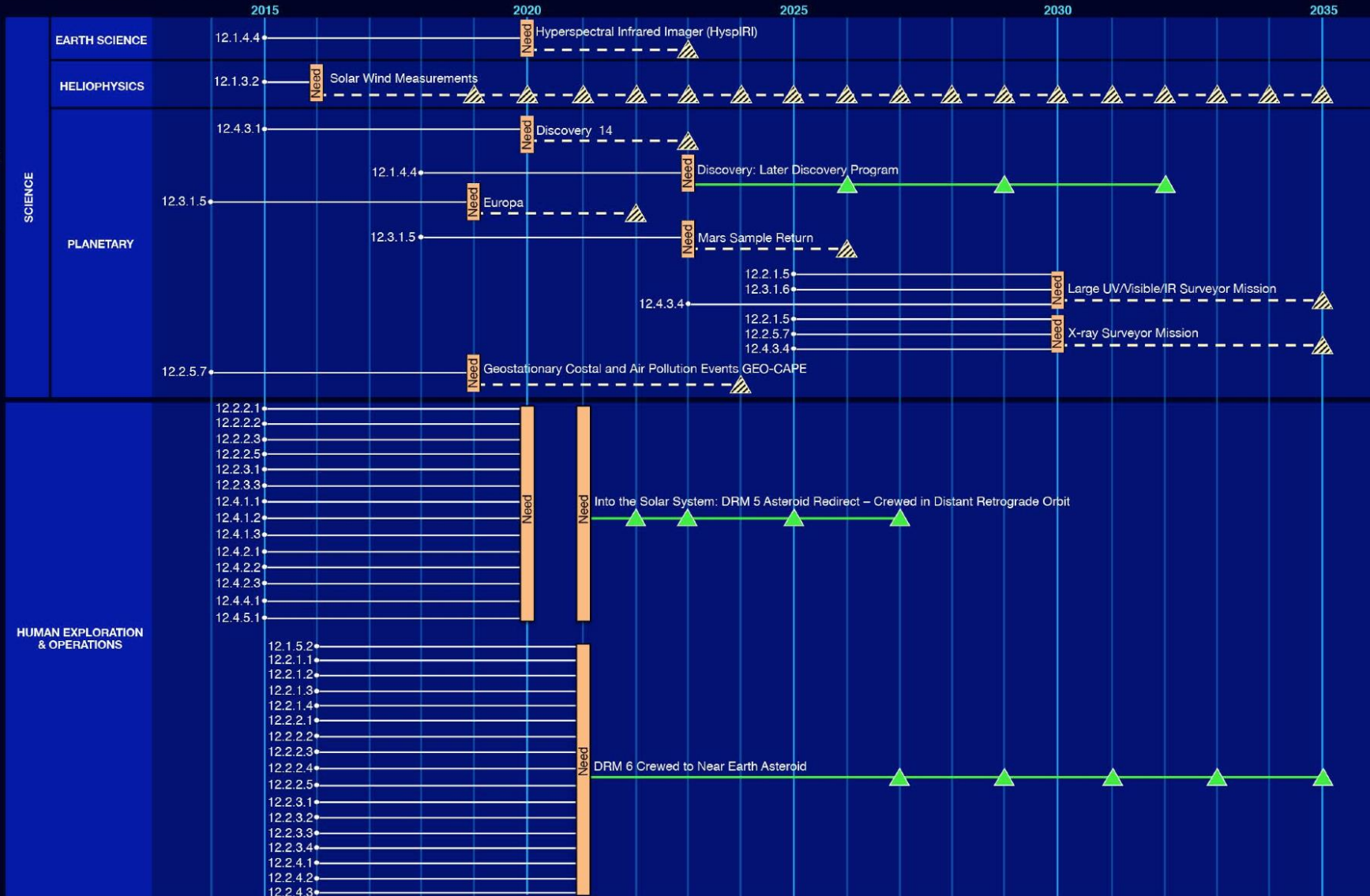
KEY:

- = Development Start Date
- Need = Technology Need Date
- ▲ = Launch Date From Agency Mission Planning Model (AMPM)
- ▲ = Launch Date Not In AMPM

4-digit numbers represent the technology candidate snapshots detailed in the Appendix.

Only technology candidates that are enabling (pull) are shown in this graphical representation


Enhancing (push) technologies are found in the Index and roadmaps.



# How to get involved?



Search TechPort for current and past technologies: <https://techport.nasa.gov>



**HOME**

**REPORTS**  
Report on programs,  
projects, and elements

**LINKS**  
Explore NASA's  
technology websites

ascent

Advanced Search

Search

**TechPort** (Beta)

Home » Search Results

33 items found | 0 items selected

## Search Results

You searched for active programs, projects, and elements containing the word **ascent**. [Click here to modify your search.](#)

Viewing 1 - 20 of 33

12>

Print Search Results

Select AllUnselect All

Standard ViewExpanded View

☐ **High-Performance, Pump-Fed Propulsion for Mars Ascent Vehicle Applications Project**

Active Project

This is a project within the SBIR/STTR Programs

To-date, the realization of high-performance liquid bipropellant rocket engines for ascent vehicle and sample return applications has largely been hindered by the inability to obtain "on-board" pressurization through a light-weight and low-complexity pump. Ventions seeks to fulfill this critical nee...

☐ **ORSC Methane Ascent/Descent Engine Technology Development Project**

Active Project

This is a project within the SBIR/STTR Programs

Special Aerospace Services (SAS) is proposing a new and innovative ascent/descent engine using methane as its propellant. This engine will utilize the concepts of the Oxidizer Rich Staged Combustion (ORSC) cycle of the RD-8 to improve on performance over existing hardware. This SBIR program will lev...

☐ **High Performance Nozzle for Mars Ascent Vehicle Project**

Active Project

This is a project within the SBIR/STTR Programs

ASTS is pleased to propose to demonstrate the feasibility of using an aerospike nozzle to provide a dramatic increase in payload capability to the two-stage, all-solid-propulsion Mars Ascent Vehicle (MAV). The aerospike features a well-known altitude compensation capability, but the MAV operates in ...



# How to get involved?



Search for patents, license opportunities, spinoffs and more: [www.technology.nasa.gov](http://www.technology.nasa.gov)



Aeronautics



Communications



Electrical/  
Electronics



Environment



Health, Medicine,  
and Biotechnology

environment



IT  
and Software



Instrumentation



Manufacturing



Materials and  
Coatings



Mechanical and  
Fluid Systems



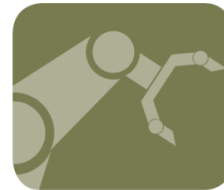
Optics



Power Generation  
and Storage



Propulsion



Robotics, Automation  
and Control



Sensors

# Questions?

